

We claim:

1. A self contained instrumented golf club, the golf club comprising:
a first accelerometer module mounted in a head of the golf club; and
a second accelerometer module mounted in a shaft of the golf club.
2. The instrumented golf club of claim 1, wherein the first accelerometer module is removably mounted within the head of the golf club.
3. The instrumented golf club of claim 2, wherein the head of the golf club is a wood.
4. The instrumented golf club of claim 2, wherein the head of the golf club is an iron.
5. The instrumented golf club of claim 1, wherein the first accelerometer module senses acceleration along three orthogonal axes.
6. The instrumented golf club of claim 1, further including an antenna that comprises a feral that connects the head of the golf club to the shaft of the golf club.
7. The instrumented golf club of claim 1, further including an impact module configured to sense the location of impact with a golf ball.
8. The instrumented golf club of claim 7, wherein the impact module comprises an array of strain gauges.
9. The instrumented golf club of claim 7, further including a grip pressure sensor.
10. The instrumented golf club of claim 1, further including a transmission module that wirelessly transmits golf swing data.

11. A computer-readable medium containing computer-executable instructions for causing a transmission module embedded within a golf club to perform the steps of:

receiving first golf swing data from a first accelerometer module mounted in a head of the golf club;

receiving second golf swing data from a second accelerometer module mounted in a shaft of the golf club; and

transmitting the first and second golf swing data.

12. The computer-readable medium of claim 11, further including computer-executable instructions for causing the transmission module to perform the steps of:

receiving ball impact location data from an impact module; and

transmitting the ball impact location data.

13. The computer-readable medium of claim 12, further including computer-executable instructions for causing the transmission module to perform the steps of:

receiving grip pressure data from a grip pressure sensor; and

transmitting the grip pressure data.

14. A user interface for displaying golf swing performance information of a golfer, the user interface comprising:

a first section displaying a measured first golf swing parameter at a location along a bar to indicate a relationship between a value of the measured first golf swing parameter and a preferred value of the first golf swing parameter.

15. The user interface of claim 14, further including:

a second section displaying a measured second golf swing parameter at a location along a bar to indicate a relationship between a value of the measured second golf swing parameter and a preferred value of the second golf swing parameter.

16. The user interface of claim 15, wherein the preferred values of the first and second golf swing parameters correspond to a golf swing selected by a user.

17. A method of providing golf swing data to a golfer; the method comprising:
(a) receiving golf swing data from a self contained instrumented golf club;
(b) displaying in real time on a portable computer device at least some of the golf swing data in relation to preferred golf swing data.

18. The method of claim 17, further including:
(c) receiving a indication that a golf swing is a preferred golf swing; and
(d) storing golf swing data corresponding to the preferred golf swing as preferred golf swing data.

19. The method of claim 17, wherein (a) comprises receiving a wireless signal.

20. The method of claim 17, wherein (b) comprises displaying a first golf swing parameter along a bar that indicates a deviation from a preferred first golf swing parameter.

21. The method of claim 20, wherein the first golf swing parameter comprises tempo.

22. The method of claim 20, wherein the first golf swing parameter comprises grip pressure.

23. The method of claim 20, wherein the first golf swing parameter comprises shaft energy transfer.

24. The method of claim 20, wherein the first golf swing parameter comprises club head speed.

25. The method of claim 20, wherein the first golf swing parameter comprises club face angle.

26. The method of claim 20, wherein the first golf swing parameter comprises a swing path.

27. The method of claim 20, wherein the first golf swing parameter comprises an impact location.

28. The method of claim 17, further including:
receiving weight transfer data from a weight transfer module; and
displaying in real time on the portable computer device the weight transfer data in relation to preferred weight transfer data.

29. An instrumented golf club system comprising:
a self contained instrumented golf club, the golf club comprising:
a first accelerometer module mounted in a head of the golf club;
a second accelerometer module mounted in a shaft of the golf club;
a wireless transmission module that transmits data from the first and second accelerometers; and
a portable computer device that receives the data transmitted by the wireless transmission module.

30. The system of claim 29, further including:
a weight distribution module that measures a golfers weight distribution during a golf swing.

31. The system of claim 30, wherein the weight distribution module is configured to fit within a pair of golf shoes.

32. A method for determining the face angle of a golf club having a shaft, the method comprising:

- (a) detecting a start of a back swing;
- (b) detecting an impact of the golf club with a ball;
- (c) determining the golf club shaft rotational rate as a function of time at least from the start in (a) until the impact in (b); and
- (d) integrating the golf club shaft rotational rate with respect to time from the start in (a) until the impact in (b).

33. The method of claim 32, wherein (a) comprises detecting velocity with a velocity sensor.

34. The method of claim 32, wherein (b) comprises detecting a spike in an angular rate of change of the shaft of the golf club.

35. A self contained instrumented golf club, the golf club comprising a gyroscope module configured to sense at least one golf swing parameter.

36. The instrumented golf club of claim 35, wherein the gyroscope module comprises a 3-axis gyroscope.

37. The instrumented golf club of claim 35, wherein the gyroscope module comprises a micro-electromechanical system.

38. The instrumented golf club of claim 35, further including an acceleration module.

39. The instrumented golf club of claim 38, wherein the acceleration module is included within the gyroscope module.

40. The instrumented golf club of claim 35, further including an antenna that comprises a feral that connects a head of the golf club to a shaft of the golf club.

41. The instrumented golf club of claim 35, further including a transmission module that wirelessly transmits golf swing data.

42. A self contained instrumented golf club, the golf club comprising a magnetic sensor module that senses the direction of the earth's magnetic field relative to a head of the golf club.

43. The instrumented golf club of claim 42, wherein the magnetic sensor module comprises an anisotropic magnetoresistive device.

44. The instrumented golf club of claim 42, wherein the magnetic sensor module comprises a giant magnetoresistor device.

45. The instrumented golf club of claim 42, wherein the magnetic sensor module is configured to resolve a vector corresponding to the earth's magnetic field into at least two component vectors.

46. The instrumented golf club of claim 45, wherein the magnetic sensor module is configured to resolve the vector corresponding to the earth's magnetic field into three component vectors.

47. The instrumented golf club of claim 42, further including an antenna that comprises a feral that connects the head of the golf club to a shaft of the golf club.

48. The instrumented golf club of claim 42, further including a transmission module that wirelessly transmits golf swing data.

49. An instrumented golf club, the golf club comprising an array of electromagnetic sensors that receive electromagnetic radiation reflected from a golf ball.

50. The instrumented golf club of claim 49, wherein the electromagnetic radiation comprises radio frequency radiation.

51. The instrumented golf club of claim 49, further including a module that measures a Doppler frequency shift of the electromagnetic radiation reflected from the golf ball.

52. The instrumented golf club of claim 49, wherein at least some of the sensors in the array of electromagnetic sensors emit electromagnetic radiation.

53. The instrumented golf club of claim 49, further including an antenna that comprises a feral that connects the head of the golf club to the shaft of the golf club.

54. The instrumented golf club of claim 49, further including a transmission module that wirelessly transmits golf swing data.

55. An instrumented golf club, the golf club comprising an array of electromagnetic sensors that receive electromagnetic radiation reflected from a golf ball.

56. The instrumented golf club of claim 55, wherein the electromagnetic radiation comprises radio frequency radiation.

57. The instrumented golf club of claim 55, further including a module that measures a Doppler frequency shift of the electromagnetic radiation reflected from the golf ball.

58. The instrumented golf club of claim 55, wherein at least some of the sensors in the array of electromagnetic sensors emit electromagnetic radiation.

59. The instrumented golf club of claim 55, further including an antenna that comprises a feral that connects a head of the golf club to a shaft of the golf club.

60. The instrumented golf club of claim 55, further including a transmission module that wirelessly transmits golf swing data.

61. An instrumented golf club, the golf club comprising an array of ultrasound sensors that receive ultrasound waves reflected from a golf ball.

62. The instrumented golf club of claim 61, further including a module that measures a Doppler frequency shift of the ultrasound waves reflected from the golf ball.

63. The instrumented golf club of claim 61, wherein at least some of the sensors in the array of ultrasound sensors emit ultrasound waves.

64. The instrumented golf club of claim 61, further including an antenna that comprises a feral that connects a head of the golf club to a shaft of the golf club.

65. The instrumented golf club of claim 61, further including a transmission module that wirelessly transmits golf swing data.